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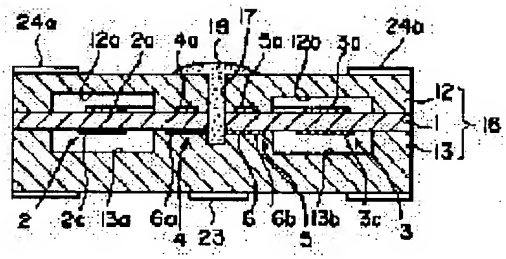
(54) PIEZOELECTRIC COMPONENT

(57)Abstract:

PURPOSE: To suppress stray capacitance generated between an input electrode and an output electrode and interference between vibrators.

CONSTITUTION: A vibrator section 2 and a capacitor section 4 are provided on the input side of a piezoelectric substrate 1 and a vibrator section 3 and a capacitor section 5 are provided on the output side of the piezoelectric substrate 1. Then the piezoelectric substrate 1 and sealing substrates 12, 13 form a laminator 16 provided with an enclosed vibration space. After a groove 17 completely separating the piezoelectric substrate 1 and the sealing substrate 12 is formed among the vibrator section 2, the capacitor section 4, the vibrator section 3, the capacitor section 5 in the laminator, the groove 17 is filled by a resin 18 whose dielectric constant is lower than that of the substrates 1, 12.



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CLAIMS

[Claim(s)]
[Claim 1] A piezo electric crystal substrate which has the two vibrator sections and the two capacitor sections at least, prepared one [said] vibrator section and capacitor section in one substrate side, and prepared the vibrator section and the capacitor section of said another side in an another side side of a substrate, A slot which is equipped with two closure substrates which form oscillating space on both sides of said piezo electric crystal substrate, and divides said piezo electric crystal substrate and one [said] closure substrate, respectively One [said] vibrator section and capacitor section, Piezo-electric components characterized by having prepared between the vibrator section of said another side, and the capacitor section, and filling up this slot with resin.
[Claim 2] A piezo electric crystal substrate with the two vibrator sections and the one capacitor section arranged between these two vibrator sections at least, It has two closure substrates which form oscillating space on both sides of said piezo electric crystal substrate. Piezo-electric components characterized by having prepared a slot which divides said piezo electric crystal substrate and one [said] closure substrate, respectively between said capacitor sections and one [said] vibrator sections and between said capacitor sections and vibrator sections of said another side, and filling up this slot with resin.
[Claim 3] A piezo-electric component according to claim 1 or 2 characterized by a reinforcement member having joined to a closure substrate divided by slot where said slot is straddled at least.
[Claim 4] A piezo electric crystal substrate which has at least two vibrator sections, and two closure substrates which form oscillating space on both sides of said piezo electric crystal substrate, A slot which is equipped with a dielectric substrate with at least one capacitor section, and divides said piezo electric crystal substrate and one [said] closure substrate, respectively Piezo-electric components characterized by preparing a slot which fills up this slot with resin while preparing between said two vibrator sections, and divides said dielectric substrate between an input side of said dielectric substrate, and an output side.
[Claim 5] A piezo-electric component according to claim 4 characterized by establishing a slot which divides a dielectric substrate even in a closure substrate which touches said dielectric substrate.
[Claim 6] Claim 1 characterized by establishing a slot which divides one closure substrate and piezo electric crystal substrate, respectively even in a closure substrate of another side, claim 2, or a piezo-electric component according to claim 3, 4, or 5.
[Claim 7] A piezo electric crystal substrate with the two vibrator sections and the one capacitor section at least, It has a propagation-of-vibration prevention member joined to two closure substrates which form oscillating space on both sides of said piezo electric crystal substrate, and one [said] closure substrate through flexible adhesives. Piezo-electric components characterized by having prepared a slot which reaches even said propagation-of-vibration prevention member between said vibrator sections while dividing said two closure substrates and said piezo electric crystal substrate, respectively, and filling up this slot with resin.

[Translation done.]

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the piezo-electric components used for an oscillator circuit, a filter circuit, etc.
[0002]
[Description of the Prior Art] Conventionally, as this kind of piezo-electric components, there is a thing of the laminating type shown in drawing 18 . This piezo-electric component constitutes the layered product from a piezo electric crystal substrate 120 which has the capacitor section for combining the two vibrator sections and these two vibrator sections, and two closure substrates 121,122 which form oscillating space on both sides of this piezo electric crystal substrate 120. An input electrode 125 and an output electrode 126 are formed in the both ends of this layered product, and the grand electrode 127 is formed in the center section.
[0003] However, if this piezo-electric component was miniaturized further, since the gap of an input electrode 125 and an output electrode 126 would become narrow, big stray capacity occurred between the input electrode 125 and the output electrode 126. Moreover, apart from this, the problem that a RF property deteriorated also had vibration produced in one vibrator section by spreading the closure substrate 121,122 and interfering in the vibrator section of another side.
[0004] Then, the technical problem of this invention is to offer the piezo-electric components of the structure where the stray capacity generated between an input electrode and an output electrode and interference between the vibrator sections can be suppressed.
[0005]
[Means for Solving the Problem and its Function] In order to solve the above technical problem, piezo-electric components concerning this invention were equipped with a piezo electric crystal substrate which has the capacitor section for combining the two vibrator sections and these two vibrator sections, and two closure substrates which form oscillating space on both sides of this piezo electric crystal substrate, and prepared a slot which divides said piezo electric crystal substrate and one [said] closure substrate, respectively between said two vibrator sections. This slot is filled up, resin, for example, epoxy system resin etc., of a dielectric constant lower than a piezo electric crystal substrate and a closure substrate etc. Therefore, since a dielectric constant of a piezo electric crystal substrate which prepared a slot, and the whole closure substrate becomes small, stray capacity generated between I/O of piezo-electric components becomes small.
[0006] Moreover, if a reinforcement member is joined to a closure substrate divided by slot where said slot is straddled at least, a fall of a mechanical strength of piezo-electric components by having prepared a slot will be compensated. Moreover, a dielectric substrate may be joined to a layered product which consists of a piezo electric crystal substrate and a closure substrate, and capacity for combining the two vibrator sections may be secured in the capacitor section prepared in a dielectric substrate. In this case, stray capacity during I/O of piezo-electric components is stopped by preparing a slot which divides a dielectric substrate into a dielectric substrate.

[0007] Furthermore, if this division slot is established even in a closure substrate of another side when forming a slot which divides a piezo electric crystal substrate and one closure substrate in a layered product which consists of a piezo electric crystal substrate and a closure substrate, said piezo electric crystal substrate and one [said] closure substrate will be divided certainly. Moreover, a propagation-of-vibration prevention member is joined to a layered product which consists of a piezo electric crystal substrate and a closure substrate through flexible adhesives, for example, adhesives of a rubber system. If structure which prepares a slot which reaches even said propagation-of-vibration prevention member between the two vibrator sections, and fills up this slot with resin is adopted while dividing said piezo electric crystal substrate and said closure substrate Vibration produced in one vibrator section is interrupted by resin and flexible adhesives which are filled up with a slot, and does not need to affect the vibrator section of another side.

[0008]

[Example] Hereafter, the example of the piezo-electric components concerning this invention is explained with reference to an accompanying drawing. In each example, the same sign was given to the same components and the same portion.

The piezo-electric components of the 1st example of [the 1st example, drawing 1 - drawing 6] contain two piezoelectric transducers and two capacitors, form one piezoelectric transducer and capacitor of them in the input side of a piezo electric crystal substrate, and form other piezoelectric transducers and capacitors in the output side of a piezo electric crystal substrate. As shown in drawing 1 , piezo-electric components consist of a piezo electric crystal substrate 1 and closure substrates 12 and 13 which form oscillating space on both sides of this piezo electric crystal substrate 1.

[0009] The piezo electric crystal substrate 1 consists of ceramic material, such as PZT. The input-side cash-drawer electrode 7 connected to vibrating electrode 2a, 2b, vibrating electrodes 3a and 3b, capacity electrode 4a, capacity electrode 5a, electrode 2b, and 3b, respectively and the output side cash-drawer electrode 8, and auxiliary electrodes 9a and 9b are formed in the surface of the piezo electric crystal substrate 1. Furthermore, as shown in drawing 2 , the capacity electrode 6 which should finally be divided into capacity electrode 6a and capacity electrode 6b by vibrating electrode 2c, vibrating electrode 3c, and the below-mentioned division slot 17 is formed in the rear face of a substrate 1 at the position. The vibrator sections 2 and 3 consist of vibrating electrodes 2a-2c, and 3a-3c, respectively, and the capacitor sections 4 and 5 consist of capacity electrodes 4a, 6a, 5a, and 6b, respectively.

[0010] The insulating closure substrates 12 and 13 are arranging the crevices 12a, 12b (refer to drawing 4), 13a, and 13b for oscillating space formation in one field. Next, the assembly procedure of the above components 1, 12, and 13 is explained. First, as shown in drawing 3 , it considers as the layered product 16 which has the oscillating space of the piezo electric crystal substrate 1 which fixed the closure substrates 12 and 13 through the adhesives of an epoxy system etc. up and down, and was sealed. The slot 17 which divides the piezo electric crystal substrate 1 and the closure substrate 12 into two is formed in this layered product 16. The depth of a slot 17 is set up in order to divide completely the piezo electric crystal substrate 1 and the closure substrate 12 at this time, to take manufacture tolerance etc. into consideration and to establish a slot 17 even in the closure substrate 13. However, if the conditions of dividing substrates 1 and 12 completely are satisfied, it is not necessary to necessarily establish a slot 17 in a substrate 13. The capacity electrode 6 is divided by the slot 17 and set to capacity electrode 6a and capacity electrode 6b. Therefore, this slot 17 will be formed between the vibrator section 2 and the capacitor section 4, the vibrator section 3, and the capacitor section 5.

[0011] Next, a slot 17 is filled up with resin 18 as shown in drawing 4 . It is used as a material of resin 18, the thing, for example, the epoxy system resin etc., of a dielectric constant lower than the piezo electric crystal substrate 1 and the closure substrates 12 and 13 etc. Resin 18 is formed in opening of a slot 17 in the condition that it was able to heap up in extensive area. It is for lessening the fall of the mechanical strength of the piezo-electric components by having formed the slot 17 by heaping up resin 18.

[0012] Next, as shown in drawing 5 , while forming an input electrode 20, an output electrode 21, and auxiliary electrodes 24a and 24b in the both ends of a layered product 16 in thin film means forming,

such as a spatter and vacuum evaporationo, respectively, the grand electrode 23 is formed in the junction electrode 22 and a back side edge side at the near-side end face of a layered product 16. And an input electrode 20 is connected to the cash-drawer electrode 7, an output electrode 21 is connected to the cash-drawer electrode 8, the junction electrode 22 is connected to the capacity electrodes 4a and 5a, and the grand electrode 23 is connected to the capacity electrodes 6a and 6b. The electric representative circuit schematic of piezo-electric components is shown in drawing 6 .

[0013] In this way, since the slot 17 filled up with resin 18 with a low dielectric constant is formed between the input electrode 20 and the output electrode 21, the dielectric constant between an input electrode 20 and an output electrode 21 becomes small, and the obtained piezo-electric components become what has the small stray capacity generated between the I/O electrodes 20-21.

The piezo-electric components of the 2nd example of [the 2nd example, drawing 7 - drawing 10] are equipped with two piezoelectric transducers and one capacitor. As shown in drawing 7 , it consists of a piezo electric crystal substrate 31 and closure substrates 42 and 43 which form oscillating space on both sides of this piezo electric crystal substrate 31. The junction cash-drawer electrodes 34a and 34b connected to vibrating electrodes 32a and 32b, vibrating electrodes 33a and 33b, the input-side cash-drawer electrode 37 connected to Electrodes 32a and 33a, respectively, the output side cash-drawer electrode 38, and Electrodes 32b and 33b, respectively and capacity electrode 36a are prepared in the surface of the piezo electric crystal substrate 31. Furthermore, as shown in drawing 8 , the gland side cash-drawer electrodes 35a and 35b connected to vibrating electrode 32c, vibrating electrode 33c, and Electrodes 32c and 33c, respectively and capacity electrode 36b are prepared in the rear face of a substrate 31 at the position. The vibrator sections 32 and 33 consist of vibrating electrodes 32a-32c, and 33a-33c, respectively, and the capacitor section 36 consists of capacity electrodes 36a and 36b. This piezo electric crystal substrate 1 will be divided by the two below-mentioned division slots 47a and 47b established in the both-sides portion of the capacitor section 36.

[0014] The insulating closure substrates 42 and 43 are arranging the crevices 42a, 42b (refer to drawing 9), 43a, and 43b for oscillating space formation in one field. As shown in drawing 9 , let these components 31, 42, and 43 be the layered products 46 which are accumulated, fix and have the sealed oscillating space. Two slots 47a and 47b which trichotomize the piezo electric crystal substrate 31 and the closure substrate 42 into this layered product 46 are formed between the vibrator section 32 and the capacitor section 36 and between the vibrator section 33 and the capacitor section 36, respectively. It fills up with resin 48 with a low dielectric constant, and resin 48 can be heaping up opening of Slots 47a and 47b for these slots 47a and 47b in extensive area.

[0015] Next, as shown in drawing 10 , while forming an input electrode 50, an output electrode 51, and auxiliary electrodes 54a and 54b in the both ends of a layered product 46 in thin film means forming, respectively, the grand electrode 53 is formed in the junction electrode 52 and a back side edge side at the near-side end face of a layered product 46. And an input electrode 50 is connected to the cash-drawer electrode 37, an output electrode 51 is connected to the cash-drawer electrode 38, the junction electrode 52 is connected to capacity electrode 36a and the junction electrodes 34a and 34b, and the grand electrode 53 is connected to capacity electrode 36b and the cash-drawer electrodes 35a and 35b.

[0016] In this way, the obtained piezo-electric components do so the same operation as the piezo-electric components of said 1st example, and an effect.

As shown in the 3rd example and [drawing 11] drawing 11 , the piezo-electric components of the 3rd example fix the reinforcement substrate 60 with adhesives, such as an epoxy system, to the layered product 16 which consists of a piezo electric crystal substrate 1 explained in said 1st example, and closure substrates 12 and 13. A slot 17 divides the piezo electric crystal substrate 1 and the closure substrate 12 into two, and is established even in the closure substrate 13. The slot 17 is filled up with resin 18 with a low dielectric constant. An input electrode 61 and an output electrode 62 are formed in the both ends of piezo-electric components, and the grand electrode 63 is formed in the center section.

[0017] The piezo-electric components which consist of the above configuration have the structure where the fall of the mechanical strength of the piezo-electric components by having formed the slot 17 with the reinforcement substrate 60 can be compensated enough while doing so the same operation as the

piezo-electric components of said 1st example, and an effect.
The piezo-electric components of the 4th example of [the 4th example, drawing 12 - drawing 16] contain two piezoelectric transducers and one capacitor. As shown in drawing 12 , it consists of a piezo electric crystal substrate 71, closure substrates 82 and 83 which form oscillating space on both sides of this piezo electric crystal substrate, and a dielectric substrate 88 (refer to drawing 14). The junction cash-drawer electrodes 77a and 77b and auxiliary electrodes 78a and 78b which were connected to the input-side cash-drawer electrode 75 connected to vibrating electrodes 72a and 72b, vibrating electrodes 73a and 73b, and Electrodes 72a and 73a, respectively and the output side cash-drawer electrode 76, and Electrodes 72b and 73b, respectively are prepared in the surface of the piezo electric crystal substrate 71. Furthermore, as shown in drawing 13 , the gland side cash-drawer electrodes 79a and 79b connected to vibrating electrode 72c, vibrating electrode 73c, and Electrodes 72c and 73c, respectively are formed in the rear face of a substrate 71. The vibrator sections 72 and 73 consist of vibrating electrodes 72a-72c, and 73a-73c, respectively. This piezo electric crystal substrate 71 will be divided by the below-mentioned division slot 87 prepared between the vibrator section 72 and the vibrator section 73. As for the closure substrates 82 and 83, the crevices 82a, 82b (refer to drawing 16), 83a, and 83b for oscillating space formation are arranged in one field.
[0018] As shown in drawing 14 , let these components 71, 82, and 83 be the layered products 85 which are accumulated, fix and have the sealed oscillating space. The slot 87 which divides the piezo electric crystal substrate 71 and the closure substrate 82 into two is formed in this layered product 85 between the vibrator section 72 and the vibrator section 73. This slot 87 is filled up with resin 88 with a low dielectric constant. The dielectric substrate 90 fixes through adhesives on the upper surface of this layered product 85. Capacity electrode 91a and the substrate electrodes 92a, 92b, 92c, and 92d are formed in the surface of the dielectric substrate 90. Capacity electrode 91b is prepared in the rear face of the dielectric substrate 90. The capacitor section 91 consists of capacity electrodes 91a and 91b.
[0019] Next, as shown in drawing 15 , while forming an input electrode 94, an output electrode 95, and auxiliary electrodes 98a and 98b in the both ends of piezo-electric components in thin film means forming, respectively, the grand electrode 97 is formed in the near-side end-face section of piezo-electric components at the junction electrode 96 and the back side end-face section. An input electrode 94 is connected to the input-side cash-drawer electrode 75, an output electrode 95 is connected to the output side cash-drawer electrode 76, the junction electrode 96 is connected to the junction cash-drawer electrodes 77a and 77b, and the grand electrode 97 is connected to the grand cash-drawer electrodes 79a and 79b.
[0020] Furthermore, in order to stop the stray capacity between an input electrode 94 and an output electrode 95, the slots 99a and 99b where width of face is wide are formed between an input electrode 94 and the grand electrode 97 and between an output electrode 95 and the grand electrode 97. These slots 99a and 99b take manufacture tolerance etc. into consideration, and are established even in the closure substrate 82 so that the dielectric substrate 90 may be trichotomized completely. However, if the conditions of dividing a substrate 90 completely are satisfied, it is not necessary to necessarily establish Slots 99a and 99b in a substrate 82. Moreover, only one slot of the slots 99a and 99b may be prepared.
[0021] Drawing 16 is the vertical cross section of the obtained piezo-electric components. Capacity occurs among the capacity electrodes 91a and 91b. This piezo-electric component does so the same operation as the piezo-electric components of said 1st example, and an effect.
As shown in the 5th example and [drawing 17] drawing 17 , the piezo-electric components of the 5th example paste up the propagation-of-vibration prevention substrate 103 on the layered product 16 which consists of a piezo electric crystal substrate 1 explained in said 1st example, and closure substrates 12 and 13 with the flexible adhesives (adhesives which have flexibility) 102. The resin adhesives of a rubber system etc. are used as a material of the flexible adhesives 102. A slot 100 divides the piezo electric crystal substrate 1 and the closure substrates 12 and 13 into two, and is established even in the propagation-of-vibration prevention substrate 103. The slot 100 is filled up with resin 101 with a low dielectric constant. The input electrode 104 and the output electrode 105 are formed in the both ends of piezo-electric components.

[0022] In the above configuration, a part of vibration generated in the vibrator sections 2 and 3, respectively is spread to the closure substrates 12 and 13. However, vibration spread to the closure substrate 12 is interrupted with the resin 101 with which the slot 100 was filled up, and vibration spread to the closure substrate 13 is interrupted by the flexible adhesives 102. Therefore, the piezo-electric components which do not interfere each other in vibration generated in the vibrator sections 2 and 3, respectively mutually, and do not have deterioration of a RF property are obtained.
[0023] the piezo-electric components concerning example] this invention besides [are not limited to said example, within the limits of the summary, can be boiled variously and can deform. About the configuration of a slot of dividing a closure substrate and a piezo electric crystal substrate, and a width-of-face size, it is arbitrary, and various things are adopted according to specification.
[0024] Moreover, although said each example is performing all electrical installation of an internal electrode by the end face of a layered product, it is not necessarily limited to this and may perform electrical installation of an internal electrode using the connecting means of a through hole etc.
[0025]
[Effect of the Invention] By the above explanation to the layered product which consisted of two closure substrates which form oscillating space on both sides of a piezo electric crystal substrate and this piezo electric crystal according to [so that clearly] this invention Since the slot which divides one [said] closure substrate and said piezo electric crystal substrate was prepared and this slot was filled up with resin with a dielectric constant lower than a piezo electric crystal substrate and a closure substrate, the dielectric constant during I/O of piezo-electric components becomes small, and piezo-electric components with the small stray capacity generated between I/O can be obtained.
[0026] Moreover, the fall of the mechanical strength of the piezo-electric components by the slot can be compensated by the reinforcement member by joining a reinforcement member to the closure substrate divided by the slot, where said slot is straddled at least. Moreover, if a dielectric substrate is joined to the layered product which consists of a piezo electric crystal substrate and a closure substrate, the capacity for combining the two vibrator sections is securable in the capacitor section prepared in the dielectric. Therefore, it becomes unnecessary to prepare the capacitor section in a piezo electric crystal substrate, area of the part and a piezo electric crystal substrate can be made small, and the small piezo-electric components of a component-side product are obtained.
[0027] Furthermore, if the slot which divides a piezo electric crystal substrate and one closure substrate, respectively is established even in the closure substrate of another side, in case a division slot will be formed, a piezo electric crystal substrate can be certainly divided for one closure substrate, and compaction of working hours can be aimed at. Moreover, while joining a propagation-of-vibration prevention member to the layered product which consists of a piezo electric crystal substrate and a closure substrate through flexible adhesives and dividing said closure substrate and piezo electric crystal substrate The slot which reaches even said propagation-of-vibration prevention member is prepared between the two vibrator sections, and if the structure which fills up this slot with resin is adopted, vibration generated in one vibrator section will be interrupted by the resin and flexible adhesives which are filled up with a slot, and will not affect the vibrator section of another side. Consequently, the piezo-electric components of the structure where interference between the vibrator sections can be suppressed can be obtained.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The assembly perspective diagram showing the 1st example of the piezo-electric components concerning this invention.
[Drawing 2] The plan of the piezo electric crystal substrate shown in drawing 1 .
[Drawing 3] The perspective diagram for explaining a division slot formation production process.
[Drawing 4] The perspective diagram showing the appearance of piezo-electric components.
[Drawing 5] The vertical cross section of X-X' of drawing 4 .
[Drawing 6] The electric representative circuit schematic of the piezo-electric components shown in drawing 5 .
[Drawing 7] The assembly perspective diagram showing the 2nd example of the piezo-electric components concerning this invention.
[Drawing 8] The plan of the piezo electric crystal substrate shown in drawing 7 .
[Drawing 9] The perspective diagram showing the appearance of piezo-electric components.
[Drawing 10] The vertical cross section of X-X' of drawing 9 .
[Drawing 11] The vertical cross section showing the 3rd example of the piezo-electric components concerning this invention.
[Drawing 12] The assembly perspective diagram showing the 4th example of the piezo-electric components concerning this invention.
[Drawing 13] The plan of the piezo electric crystal substrate shown in drawing 12 .
[Drawing 14] The assembly perspective diagram for explaining the assembly production process following drawing 12 .
[Drawing 15] The perspective diagram showing the appearance of piezo-electric components.
[Drawing 16] The vertical cross section of X-X' of drawing 15 .
[Drawing 17] The vertical cross section showing the 5th example of the piezo-electric components concerning this invention.
[Drawing 18] The perspective diagram showing the conventional example.
[Description of Notations]
1 -- Piezo electric crystal substrate
2 3 -- Vibrator section
4 5 -- Capacitor section
12 13 -- Closure substrate
17 -- Slot
18 -- Resin
31 -- Piezo electric crystal substrate
32 33 -- Vibrator section
36 -- Capacitor section
42 43 -- Closure substrate
47a, 47b -- Slot

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48 -- Resin
60 -- Reinforcement substrate
71 -- Piezo electric crystal substrate
72 73 -- Vibrator section
82 83 -- Closure substrate
87 -- Slot
88 -- Resin
90 -- Dielectric substrate
91 -- Capacitor section
99a, 99b -- Slot
100 -- Slot
101 -- Resin
102 -- Flexible adhesives
103 -- Propagation-of-vibration prevention substrate

[Translation done.]

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TITLE: PIEZOELECTRIC COMPONENT

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US-CL-CURRENT: 333/191

ABSTRACT:

PURPOSE: To suppress stray capacitance generated between an input electrode and an output electrode and interference between vibrators.

CONSTITUTION: A vibrator section 2 and a capacitor section 4 are provided on the input side of a piezoelectric substrate 1 and a vibrator section 3 and a capacitor section 5 are provided on the output side of the piezoelectric substrate 1. Then the piezoelectric substrate 1 and sealing substrates 12, 13 form a laminator 16 provided with an enclosed vibration space. After a groove 17 completely separating the piezoelectric substrate 1 and the sealing substrate 12 is formed among the vibrator section 2, the capacitor section 4, the vibrator section 3, the capacitor section 5 in the laminator, the groove 17 is filled by a resin 18 whose dielectric constant is lower than that of the substrates 1, 12.

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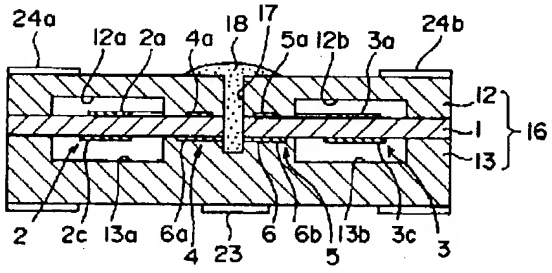
(54)【発明の名称】　圧電部品

(57)【要約】

【目的】　入力電極と出力電極の間に発生する浮遊容量や振動子部相互間の干渉を抑えることができる構造の圧電部品を得る。

【構成】　振動子部２及びコンデンサ部４を圧電体基板１の入力側に設け、振動子部３及びコンデンサ部５を圧電体基板１の出力側に設ける。そして、圧電体基板１と封止基板１２，１３とで密閉された振動空間を備えた積層体１６を構成する。この積層体の振動子部２及びコンデンサ部４と、振動子部３及びコンデンサ部５との間に、圧電体基板１及び封止基板１２を完全に分割する溝１７を形成した後、この溝１７を基板１，１２より誘電率の低い樹脂１８にて充填する。



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【特許請求の範囲】

【請求項１】　二つの振動子部と二つのコンデンサ部を少なくとも有し、前記一方の振動子部及びコンデンサ部を基板の一方の側に設け、前記他方の振動子部及びコンデンサ部を基板の他方の側に設けた圧電体基板と、
前記圧電体基板を挟んで振動空間を形成する二つの封止基板とを備え、
前記圧電体基板と前記一方の封止基板をそれぞれ分割する溝を、前記一方の振動子部及びコンデンサ部と、前記他方の振動子部及びコンデンサ部との間に設け、この溝に樹脂を充填したこと、
を特徴とする圧電部品。

【請求項２】　二つの振動子部とこの二つの振動子部の間に配設された一つのコンデンサ部とを少なくとも有した圧電体基板と、
前記圧電体基板を挟んで振動空間を形成する二つの封止基板とを備え、
前記圧電体基板と前記一方の封止基板をそれぞれ分割する溝を、前記コンデンサ部と前記一方の振動子部の間、及び前記コンデンサ部と前記他方の振動子部の間に設け、この溝に樹脂を充填したこと、
を特徴とする圧電部品。

【請求項３】　溝によって分割された封止基板に、少なくとも前記溝に跨った状態で補強部材が接合していることを特徴とする請求項１又は請求項２記載の圧電部品。

【請求項４】　少なくとも二つの振動子部を有する圧電体基板と、
前記圧電体基板を挟んで振動空間を形成する二つの封止基板と、
少なくとも一つのコンデンサ部を有した誘電体基板とを備え、
前記圧電体基板と前記一方の封止基板をそれぞれ分割する溝を、前記二つの振動子部の間に設けると共にこの溝に樹脂を充填し、前記誘電体基板を分割する溝を前記誘電体基板の入力側と出力側の間に設けたこと、
を特徴とする圧電部品。

【請求項５】　誘電体基板を分割する溝が、前記誘電体基板に接する封止基板にまで設けられていることを特徴とする請求項４記載の圧電部品。

【請求項６】　一方の封止基板と圧電体基板をそれぞれ分割する溝を、他方の封止基板にまで設けたことを特徴とする請求項１又は請求項２又は請求項３又は請求項４又は請求項５記載の圧電部品。

【請求項７】　二つの振動子部と一つのコンデンサ部を少なくとも有した圧電体基板と、
前記圧電体基板を挟んで振動空間を形成する二つの封止基板と、
前記一方の封止基板にフレキシブル接着剤を介して接合した振動伝搬防止部材とを備え、
前記二つの封止基板と前記圧電体基板をそれぞれ分割すると共に前記振動伝搬防止部材にまで達する溝を前記振動子部の間に設け、この溝に樹脂を充填したこと、を特徴とする圧電部品。

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【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、発振回路、フィルタ回路等に使用される圧電部品に関する。

【０００２】

【従来の技術と課題】従来より、この種の圧電部品としては、図１８に示す積層タイプのものがある。この圧電部品は、二つの振動子部とこの二つの振動子部を結合するためのコンデンサ部を有する圧電体基板１２０と、この圧電体基板１２０を挟んで振動空間を形成する二つの封止基板１２１，１２２とで積層体を構成している。この積層体の両端部には入力電極１２５、出力電極１２６が設けられ、中央部にはグランド電極１２７が設けられている。

【０００３】ところが、この圧電部品をさらに小型化すると、入力電極１２５と出力電極１２６の間隔が狭くなるため、入力電極１２５と出力電極１２６との間に大きな浮遊容量が発生した。また、これとは別に、一方の振動子部で生じた振動が、封止基板１２１，１２２を伝搬して他方の振動子部に干渉することにより、高周波特性が劣化するという問題もあった。

【０００４】そこで、本発明の課題は、入力電極と出力電極の間に発生する浮遊容量や振動子部相互間の干渉を抑えることができる構造の圧電部品を提供することにある。

【０００５】

【課題を解決するための手段と作用】以上の課題を解決するため、本発明に係る圧電部品は、二つの振動子部とこの二つの振動子部を結合するためのコンデンサ部を有する圧電体基板と、この圧電体基板を挟んで振動空間を形成する二つの封止基板とを備え、前記圧電体基板と前記一方の封止基板をそれぞれ分割する溝を前記二つの振動子部の間に設けた。この溝には、圧電体基板や封止基板より低い誘電率の樹脂、例えばエポキシ系樹脂等が充填される。従って、溝を設けた圧電体基板及び封止基板全体の誘電率が小さくなるため、圧電部品の入出力間に発生する浮遊容量が小さくなる。

【０００６】また、溝によって分割された封止基板に、少なくとも前記溝に跨った状態で補強部材を接合させれば、溝を設けたことによる圧電部品の機械的強度の低下が補償される。また、誘電体基板を圧電体基板と封止基板からなる積層体に接合し、二つの振動子部を結合するための容量を誘電体基板に設けたコンデンサ部にて確保してもよい。この場合、誘電体基板に誘電体基板を分割する溝を設けることにより、圧電部品の入出力間の浮遊容量が抑えられる。

【０００７】さらに、圧電体基板と封止基板からなる積

層体に、圧電体基板と一方の封止基板を分割する溝を形成する場合、この分割溝を他方の封止基板にまで設けるようにすれば、前記圧電体基板と前記一方の封止基板は確実に分割される。また、振動伝搬防止部材をフレキシブル接着剤、例えばゴム系の接着剤を介して圧電体基板と封止基板からなる積層体に接合し、前記圧電体基板と前記封止基板を分割すると共に前記振動伝搬防止部材にまで達する溝を二つの振動子部の間に設け、この溝に樹脂を充填する構造を採用すれば、一方の振動子部に生じる振動は溝を充填する樹脂とフレキシブル接着剤によって遮られ、他方の振動子部に影響を及ぼさなくてすむ。

【０００８】

【実施例】以下、本発明に係る圧電部品の実施例を添付図面を参照して説明する。各実施例において同一部品及び同一部分には同じ符号を付した。

［第１実施例、図１～図６］第１実施例の圧電部品は、二つの圧電振動子と二つのコンデンサを内蔵したものであり、そのうちの一つの圧電振動子とコンデンサを圧電体基板の入力側に設け、他の圧電振動子とコンデンサを圧電体基板の出力側に設けたものである。図１に示すように、圧電部品は、圧電体基板１と、この圧電体基板１を挟んで振動空間を形成する封止基板１２，１３とで構成されている。

【０００９】圧電体基板１は、ＰＺＴ等のセラミック材からなる。圧電体基板１の表面には、振動電極２ａ，２ｂ、振動電極３ａ，３ｂ、容量電極４ａ、容量電極５ａ、電極２ｂ，３ｂにそれぞれ接続された入力側引出し電極７及び出力側引出し電極８、補助電極９ａ，９ｂが設けられている。さらに、基板１の裏面には、図２に示すように、振動電極２ｃ，振動電極３ｃ及び後述の分割溝１７によって最終的には容量電極６ａと容量電極６ｂに分割されるべき容量電極６が所定の位置に設けられている。振動子部２，３はそれぞれ振動電極２ａ～２ｃ，３ａ～３ｃにて構成され、コンデンサ部４，５はそれぞれ容量電極４ａ，６ａ、５ａ，６ｂにて構成されている。

【００１０】絶縁性封止基板１２，１３は、一方の面に振動空間形成用凹部１２ａ，１２ｂ（図４参照）、１３ａ，１３ｂを配設している。次に、以上の構成品１，１２，１３の組立て手順について説明する。まず、図３に示すように圧電体基板１の上下に封止基板１２，１３をエポキシ系の接着剤等を介して固着し、密閉された振動空間を有する積層体１６とする。この積層体１６に圧電体基板１及び封止基板１２を２分割する溝１７を形成する。このとき、圧電体基板１及び封止基板１２を完全に分割するため、製造公差等も考慮して溝１７を封止基板１３にまで設けるべく、溝１７の深さが設定される。ただし、基板１，１２を完全に分割するという条件を満足すれば、必ずしも基板１３に溝１７を設ける必要はない。容量電極６は溝１７によって分割され、容量電極６

ａと容量電極６ｂとされる。従って、この溝１７は、振動子部２及びコンデンサ部４と振動子部３及びコンデンサ部５との間に設けられることとなる。

【００１１】次に、図４に示すように、溝１７に樹脂１８を充填する。樹脂１８の材料としては、圧電体基板１や封止基板１２，１３より低い誘電率のもの、例えばエポキシ系樹脂等が用いられる。樹脂１８は溝１７の開口部に広面積に盛り上げられた状態で形成されている。溝１７を形成したことによる圧電部品の機械的強度の低下を樹脂１８を盛り上げることによって少なくするためである。

【００１２】次に、図５に示すように、積層体１６の両端部にスパッタや蒸着等の薄膜形成手段にて入力電極２０、出力電極２１及び補助電極２４ａ，２４ｂをそれぞれ形成すると共に、積層体１６の手前側端面に中継電極２２、奥側端面にグランド電極２３を形成する。そして、入力電極２０は引出し電極７に接続され、出力電極２１は引出し電極８に接続され、中継電極２２は容量電極４ａ，５ａに接続され、グランド電極２３は容量電極６ａ，６ｂに接続される。図６に圧電部品の電気等価回路図を示す。

【００１３】こうして得られた圧電部品は、入力電極２０と出力電極２１の間に誘電率の低い樹脂１８にて充填された溝１７が形成されているので、入力電極２０と出力電極２１の間の誘電率が小さくなり、入出力電極２０－２１間に発生する浮遊容量が小さいものとなる。

［第２実施例、図７～図１０］第２実施例の圧電部品は、二つの圧電振動子と一つのコンデンサを備えたものである。図７に示すように、圧電体基板３１と、この圧電体基板３１を挟んで振動空間を形成する封止基板４２，４３とで構成されている。圧電体基板３１の表面には、振動電極３２ａ，３２ｂ、振動電極３３ａ，３３ｂ、電極３２ａ，３３ａにそれぞれ接続された入力側引出し電極３７、出力側引出し電極３８、電極３２ｂ，３３ｂにそれぞれ接続された中継引出し電極３４ａ，３４ｂ及び容量電極３６ａが設けられている。さらに、基板３１の裏面には、図８に示すように、振動電極３２ｃ、振動電極３３ｃ、電極３２ｃ，３３ｃにそれぞれ接続されたグランド側引出し電極３５ａ，３５ｂ及び容量電極３６ｂが所定の位置に設けられている。振動子部３２，３３はそれぞれ振動電極３２ａ～３２ｃ，３３ａ～３３ｃにて構成され、コンデンサ部３６は容量電極３６ａ，３６ｂにて構成されている。この圧電体基板１は、コンデンサ部３６の両側部分に設けられる後述の２本の分割溝４７ａ，４７ｂによって分割されることとなる。

【００１４】絶縁性封止基板４２，４３は一方の面に振動空間形成用凹部４２ａ，４２ｂ（図９参照）、４３ａ，４３ｂを配設している。図９に示すように、これらの構成品３１，４２，４３は積み重ねられて固着され、密閉された振動空間を有する積層体４６とされる。この

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積層体４６には圧電体基板３１及び封止基板４２を３分割する２本の溝４７ａ及び４７ｂが、それぞれ振動子部３２とコンデンサ部３６の間及び振動子部３３とコンデンサ部３６の間に形成される。この溝４７ａ，４７ｂは誘電率の低い樹脂４８が充填されており、溝４７ａ，４７ｂの開口部は樹脂４８が広面積に盛り上げられている。

【００１５】次に、図１０に示すように、積層体４６の両端部に薄膜形成手段にて入力電極５０、出力電極５１及び補助電極５４ａ，５４ｂをそれぞれ形成すると共に、積層体４６の手前側端面に中継電極５２、奥側端面にグランド電極５３を形成する。そして、入力電極５０は引出し電極３７に接続され、出力電極５１は引出し電極３８に接続され、中継電極５２は容量電極３６ａ及び中継電極３４ａ，３４ｂに接続され、グランド電極５３は容量電極３６ｂ及び引出し電極３５ａ，３５ｂに接続される。

【００１６】こうして得られた圧電部品は、前記第１実施例の圧電部品と同様の作用、効果を奏する。

［第３実施例、図１１］図１１に示すように、第３実施例の圧電部品は、前記第１実施例において説明した圧電体基板１と封止基板１２，１３とで構成される積層体１６に、エポキシ系等の接着剤にて補強基板６０を固着したものである。溝１７は圧電体基板１と封止基板１２を２分割し、封止基板１３にまで設けられている。溝１７は誘電率の低い樹脂１８にて充填されている。圧電部品の両端部には入力電極６１、出力電極６２が設けられ、中央部にはグランド電極６３が設けられている。

【００１７】以上の構成からなる圧電部品は前記第１実施例の圧電部品と同様の作用、効果を奏すると共に、補強基板６０によって溝１７を形成したことによる圧電部品の機械的強度の低下を充分補償することができる構造となっている。

［第４実施例、図１２～図１６］第４実施例の圧電部品は、二つの圧電振動子と一つのコンデンサを内蔵したものである。図１２に示すように、圧電体基板７１と、この圧電体基板を挟んで振動空間を形成する封止基板８２，８３と、誘電体基板８８（図１４参照）とで構成されている。圧電体基板７１の表面には振動電極７２ａ，７２ｂ、振動電極７３ａ，７３ｂ、電極７２ａ，７３ａにそれぞれ接続された入力側引出し電極７５及び出力側引出し電極７６、電極７２ｂ，７３ｂにそれぞれ接続された中継引出し電極７７ａ，７７ｂ、補助電極７８ａ，７８ｂが設けられている。さらに、基板７１の裏面には、図１３に示すように、振動電極７２ｃ、振動電極７３ｃ、電極７２ｃ，７３ｃにそれぞれ接続されたグランド側引出し電極７９ａ，７９ｂが設けられている。振動子部７２，７３はそれぞれ振動電極７２ａ～７２ｃ，７３ａ～７３ｃにて構成されている。この圧電体基板７１は、振動子部７２と振動子部７３の間に設けられる後述

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の分割溝８７によって分割されることになる。封止基板８２，８３は一方の面には振動空間形成用凹部８２ａ，８２ｂ（図１６参照）、８３ａ，８３ｂが配設されている。

【００１８】図１４に示すように、これらの構成品７１，８２，８３は積み重ねられて固着され、密閉された振動空間を有する積層体８５とされる。この積層体８５に圧電体基板７１及び封止基板８２を２分割する溝８７が、振動子部７２と振動子部７３の間に形成される。この溝８７は誘電率の低い樹脂８８にて充填されている。この積層体８５の上面に誘電体基板９０が接着剤を介して固着する。誘電体基板９０の表面には容量電極９１ａ、下地電極９２ａ，９２ｂ，９２ｃ，９２ｄが設けられている。誘電体基板９０の裏面には容量電極９１ｂが設けられている。コンデンサ部９１は容量電極９１ａ，９１ｂにて構成されている。

【００１９】次に、図１５に示すように、圧電部品の両端部に薄膜形成手段にて入力電極９４、出力電極９５及び補助電極９８ａ，９８ｂをそれぞれ形成すると共に、圧電部品の手前側端面部に中継電極９６、奥側端面部にグランド電極９７を形成する。入力電極９４は入力側引出し電極７５に接続され、出力電極９５は出力側引出し電極７６に接続され、中継電極９６は中継引出し電極７７ａ，７７ｂに接続され、グランド電極９７はグランド引出し電極７９ａ，７９ｂに接続される。

【００２０】さらに、入力電極９４と出力電極９５間の浮遊容量を抑えるために、入力電極９４とグランド電極９７の間及び出力電極９５とグランド電極９７の間に幅の広い溝９９ａ，９９ｂを形成する。この溝９９ａ，９９ｂは誘電体基板９０を完全に３分割するように、製造公差等も考慮して封止基板８２にまで設けられている。但し、基板９０を完全に分割するという条件を満足すれば、必ずしも基板８２に溝９９ａ，９９ｂを設ける必要はない。また、溝９９ａ，９９ｂのいずれか一方の溝だけを設けるものであってもよい。

【００２１】図１６は得られた圧電部品の垂直断面図である。容量電極９１ａと９１ｂの間に容量が発生する。この圧電部品は前記第１実施例の圧電部品と同様の作用、効果を奏する。

［第５実施例、図１７］図１７に示すように、第５実施例の圧電部品は、前記第１実施例において説明した圧電体基板１と封止基板１２，１３とで構成される積層体１６に、フレキシブル接着剤（柔軟性を有する接着剤）１０２にて振動伝搬防止基板１０３を接着したものである。フレキシブル接着剤１０２の材料としては、ゴム系の樹脂接着剤等が用いられる。溝１００は圧電体基板１と封止基板１２，１３を２分割し、振動伝搬防止基板１０３にまで設けられている。溝１００は誘電率の低い樹脂１０１にて充填されている。圧電部品の両端部には入力電極１０４及び出力電極１０５が設けられている。

【００２２】以上の構成において、振動子部２及び３にてそれぞれ発生した振動は一部封止基板１２，１３に伝搬される。しかし、封止基板１２に伝搬した振動は溝１００に充填された樹脂１０１によって遮られ、封止基板１３に伝搬した振動はフレキシブル接着剤１０２によって遮られる。従って、振動子部２及び３にてそれぞれ発生した振動は、相互に干渉し合うことがなく、高周波特性の劣化のない圧電部品が得られる。

【００２３】［他の実施例］本発明に係る圧電部品は前記実施例に限定されるものではなく、その要旨の範囲内で種々に変形することができる。封止基板や圧電体基板を分割する溝の形状、幅寸法等については任意であり、仕様に合わせて種々のものが採用される。

【００２４】また、前記各実施例は内部電極の電気的接続を全て積層体の端面で行っているが、必ずしもこれに限定されるものではなく、スルーホール等の接続手段を用いて内部電極の電気的接続を行ってもよい。

【００２５】

【発明の効果】以上の説明で明らかなように、本発明によれば、圧電体基板とこの圧電体を挟んで振動空間を形成する二つの封止基板とで構成された積層体に、前記一方の封止基板と前記圧電体基板を分割する溝を設け、この溝に圧電体基板や封止基板より誘電率の低い樹脂を充填したので、圧電部品の入出力間の誘電率が小さくなり、入出力間に発生する浮遊容量が小さい圧電部品を得ることができる。

【００２６】また、溝によって分割された封止基板に、少なくとも前記溝に跨った状態で補強部材を接合させることにより、溝による圧電部品の機械的強度の低下を補強部材によって補償することができる。また、誘電体基板を圧電体基板と封止基板からなる積層体に接合すれば、二つの振動子部を結合するための容量を誘電体に設けたコンデンサ部にて確保することができる。従って、圧電体基板にコンデンサ部を設ける必要がなくなり、その分、圧電体基板の面積を小さくすることができ、実装面積の小さい圧電部品が得られる。

【００２７】さらに、圧電体基板と一方の封止基板をそれぞれ分割する溝を他方の封止基板にまで設けるようにすれば、分割溝を形成する際、一方の封止基板を圧電体基板を確実に分割することができ、作業時間の短縮が図れる。また、振動伝搬防止部材をフレキシブル接着剤を介して圧電体基板と封止基板からなる積層体に接合し、前記封止基板と圧電体基板を分割すると共に、前記振動伝搬防止部材にまで達する溝を二つの振動子部の間に設け、この溝に樹脂を充填する構造を採用すれば、一方の振動子部に発生した振動は溝を充填する樹脂とフレキシブル接着剤によって遮られ、他方の振動子部に影響を及ぼさない。この結果、振動子部相互間の干渉を抑えることができる構造の圧電部品を得ることができる。

【図面の簡単な説明】

【図１】本発明に係る圧電部品の第１実施例を示す組立て斜視図。

【図２】図１に示されている圧電体基板の平面図。

【図３】分割溝形成工程を説明するための斜視図。

【図４】圧電部品の外観を示す斜視図。

【図５】図４のＸ－Ｘ’の垂直断面図。

【図６】図５に示した圧電部品の電気等価回路図。

【図７】本発明に係る圧電部品の第２実施例を示す組立て斜視図。

【図８】図７に示されている圧電体基板の平面図。

【図９】圧電部品の外観を示す斜視図。

【図１０】図９のＸ－Ｘ’の垂直断面図。

【図１１】本発明に係る圧電部品の第３実施例を示す垂直断面図。

【図１２】本発明に係る圧電部品の第４実施例を示す組立て斜視図。

【図１３】図１２に示されている圧電体基板の平面図。

【図１４】図１２に続く組立て工程を説明するための組立て斜視図。

【図１５】圧電部品の外観を示す斜視図。

【図１６】図１５のＸ－Ｘ’の垂直断面図。

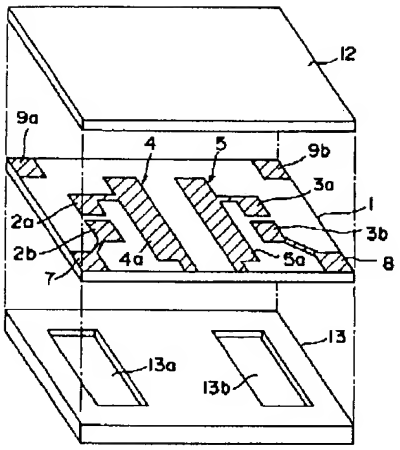
【図１７】本発明に係る圧電部品の第５実施例を示す垂直断面図。

【図１８】従来例を示す斜視図。

【符号の説明】

１…圧電体基板
２，３…振動子部
４，５…コンデンサ部
１２，１３…封止基板
１７…溝
１８…樹脂
３１…圧電体基板
３２，３３…振動子部
３６…コンデンサ部
４２，４３…封止基板
４７ａ，４７ｂ…溝
４８…樹脂
６０…補強基板
７１…圧電体基板
７２，７３…振動子部
８２，８３…封止基板
８７…溝
８８…樹脂
９０…誘電体基板
９１…コンデンサ部
９９ａ，９９ｂ…溝
１００…溝
１０１…樹脂
１０２…フレキシブル接着剤
１０３…振動伝搬防止基板

【図1】



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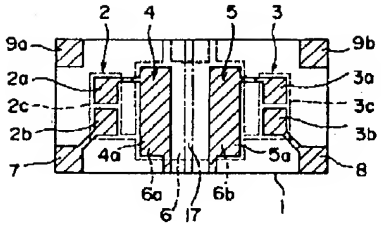

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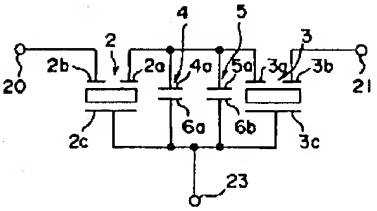

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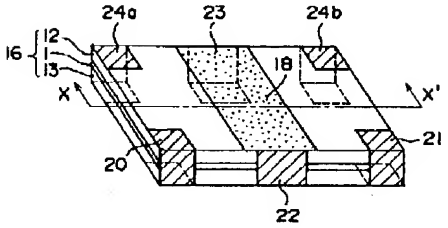

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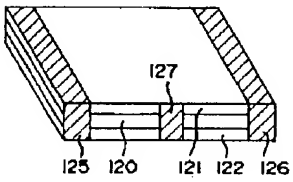

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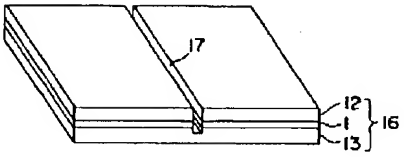

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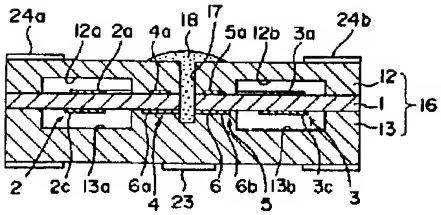

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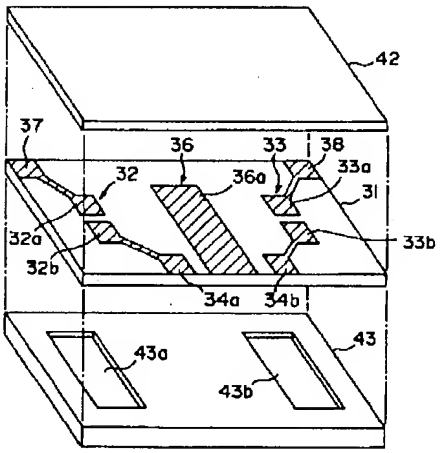

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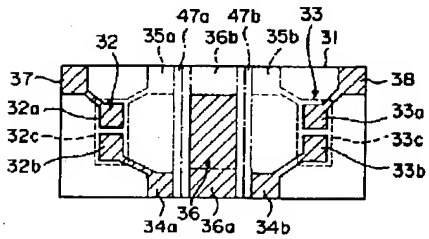

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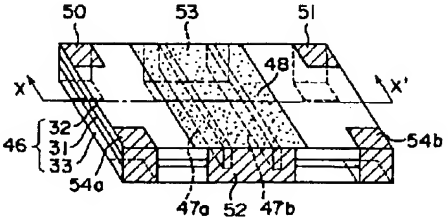

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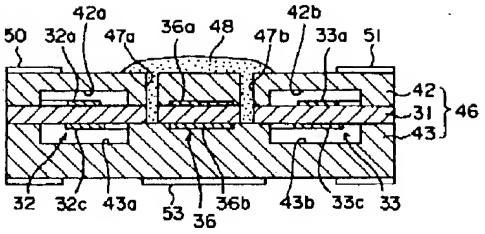

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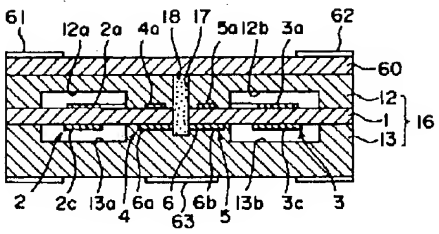

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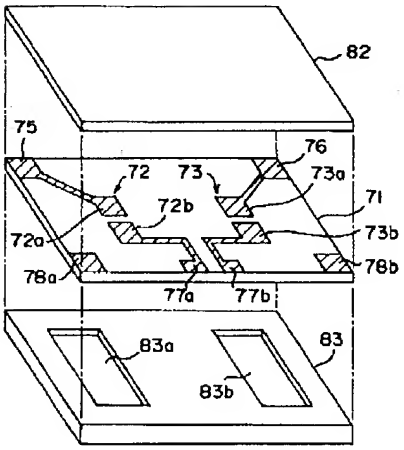

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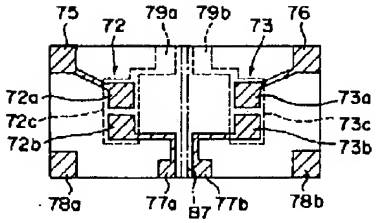

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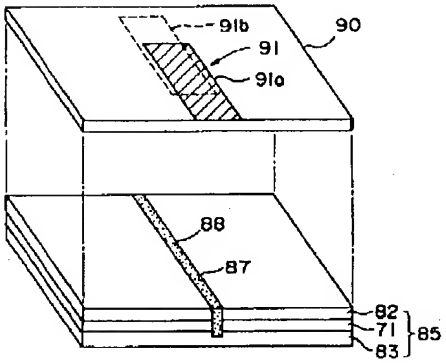

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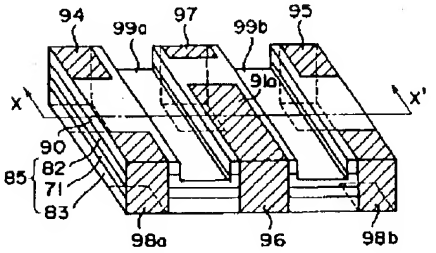

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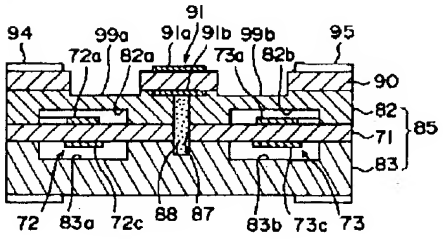

【図17】